Text table 3-20.
Total S&E jobs: 1998 and projected 2008
(Numbers in thousands of jobs)

	1998	2008	Change
Total, all occupations	**140,514**	**160,795**	**20,281**
All S&E occupations	3,809	5,747	1,937
Scientists	2,347	3,995	1,647
Life scientists	173	219	45
Computer, mathematical, and operations research occupations	1,653	3,182	1,529
Computer systems analysts, engineers, and scientists	1,530	3,052	1,522
Computer engineers and scientists	914	1,858	944
Systems analysts	617	1,194	577
Mathematical scientists	123	131	8
Physical scientists	200	229	29
Social scientists	321	365	44
Engineers	1,462	1,752	290

See appendix table 3-28. *Science & Engineering Indicators – 2000*

Within engineering, electrical-electronic engineering is projected to have the biggest absolute and relative employment gains, up by 93,000 jobs, or about 26 percent. Civil and mechanical engineers are also expected to experience above-average employment gains, with projected increases of about 21 and 16 percent, respectively. Employment for all engineering occupations is expected to increase by an average of approximately 20 percent.

Job opportunities in life science occupations are projected to grow by 26 percent (45,000 new jobs) over the 1998–2008 period; at 35 percent, the biological sciences are expected to experience the largest growth (28,000 new jobs). Employment in physical science occupations is expected to increase by about 15 percent, from 200,000 to 229,000 jobs; slightly less than half of the projected job gains are for chemists (13,000 new jobs).

Social science occupations are expected to experience only average growth (14 percent) over the decade, largely because of the modest employment increases anticipated for psychologists (11 percent or 19,000 new jobs). Economists, however, are projected to experience more favorable job growth (19 percent or 13,000 new jobs).

Foreign-Born Scientists and Engineers in the United States

In April 1997, 26.1 percent of holders of doctorates in S&E in the United States were foreign born. This is shown in text table 3-22 with data from the 1997 NSF/SRS SESTAT data file, a large national sample of those with U.S. S&E degrees and those with foreign S&E degrees who were in the United

What Fields Did Computer Workers Get Degrees In?

In 1993 only 28.5 percent of college graduates employed in computer occupations had computer science degrees, with another 2.9 percent having degrees in the closely related field of computer and systems engineering and 6.7 percent in the sometimes closely related field of electrical engineering (text table 3-21).* Perhaps reflecting the role of business departments and schools in initially introducing computer training on many campuses, 17.7 percent had business degrees. Altogether, 32.5 percent of those in computer occupations in 1993 had degrees in fields outside science, engineering, or technology (SE&T), and another 29.6 percent had degrees in SE&T fields not directly related to computing. This picture is very different for computer workers under age 30: 45.2 percent have computer science degrees, 4.9 percent degrees in computer and systems engineering, and 8.9 percent in electrical engineering. Only 16.5 percent had degrees in non-SE&T fields.

*1993 is the only year in the 1990s for which both field of degree and occupation are available on a major workforce survey for all college graduates. The 1993 SESTAT file augmented with the non-S&E records from the 1993 National Survey of College Graduates provides a valid national sample for this population.

Text table 3–21.
Field of highest degree for 1993 computer job holders

	(Percent)		
Field of highest degree	All ages	Age < 30	Age 30+
Computer sciences	28.5	45.2	25.4
Mathematics	8.9	6.6	9.3
Life sciences	2.1	0.6	2.4
Physical sciences	3.5	2.0	3.8
Social sciences	7.0	6.5	7.1
Computer & systems engineering	2.9	4.9	2.5
Electrical engineering	6.7	8.9	6.3
Mechanical engineering	1.2	1.2	1.2
Other engineering	3.0	2.9	3.0
Business	17.7	10.5	19.0
Education	4.2	0.6	4.9
Technology	3.9	4.5	3.8
Humanities	6.1	2.7	6.7
Other non-S&E	4.5	2.7	4.8
Total (n = 1,243,300)	100.0	100.0	100.0

— = Data not available.

SOURCE: National Science Foundation, Division of Science Resources Studies (NSF/SRS), SESTAT Data file, 1993.

Science & Engineering Indicators – 2000

Text table 3–22.
Percentage foreign-born, S&E trained U.S. scientists and engineers, by field of highest degree and degree level: 1997

Field of highest degree	Labor force, total	Bachelor's	Master's	Doctorate
All S&E	12.7	9.7	19.2	26.1
Engineering	19.8	14.9	30.1	44.0
Aerospace engineering	12.4	10.0	14.3	37.2
Chemical engineering	21.4	15.8	35.6	40.1
Civil engineering	21.2	16.5	33.8	52.0
Electrical engineering	22.7	18.0	32.2	46.8
Industrial engineering	16.9	11.2	32.3	50.9
Mechanical engineering	17.8	13.5	32.7	45.4
Other engineering	17.4	10.8	23.1	40.3
Life sciences	10.7	7.8	12.8	24.7
Agriculture	6.9	4.3	14.4	21.7
Biological sciences	12.3	9.3	13.0	25.5
Math/computer sciences	16.5	12.7	24.6	35.6
Computer sciences	20.4	15.6	30.8	49.5
Mathematical sciences	11.8	9.4	14.8	30.7
Physical sciences	16.0	11.8	17.2	28.5
Chemistry	20.0	15.9	23.9	29.1
Geosciences	8.0	5.4	10.2	19.5
Physics/astronomy	18.8	11.8	18.6	30.8
Other phys sciences	10.2	8.8	12.2	30.0
Social sciences	7.0	6.1	9.4	12.7
Economics	13.7	11.2	26.3	26.4
Political science	7.0	6.2	10.3	15.7
Psychology	5.4	5.1	5.8	7.2
Sociology/Anthropology	4.9	3.9	12.1	13.1
Other social sciences	7.7	6.3	10.7	20.3

SOURCE: National Science Foundation, Division of Science Resources Studies (NSF/SRS), SESTAT Data file, 1997.

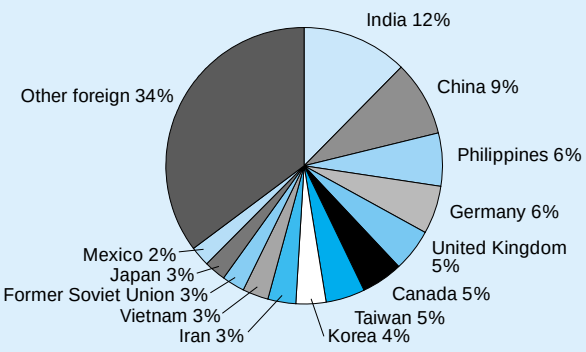
Science and Engineering Indicators – 2000

States in 1990.[28] The lowest percentage of foreign-born doctorates was in psychology (7.2 percent) and the highest was in civil engineering (52.0 percent). Almost one-fifth (19.2 percent) of those with master's degree in S&E were foreign born. Even at the bachelor's degree level, 9.7 percent of those with S&E degrees were foreign born—with the greatest proportion in chemistry (15.9 percent), computer sciences (15.6 percent), and across all engineering fields (14.9 percent).

Immigrant scientists come from a wide variety of countries. Countries contributing more than 30,000 natives to the 1.5 million S&E degree holders in the United States are shown in figure 3-15. Although no one source country dominates, 12 percent originated from India, 9 percent from China, 6 percent from the Philippines, and 6 percent from Germany (including those born in the former East Germany). By region, 57 percent originated in Asia (including the Western Asia sections of the Middle East), 24 percent from Europe, 13 percent from Central and South America, 6 percent from Canada and Oceania, and 4 percent from Africa.

The Immigration and Naturalization Service (INS) counts of permanent visas issued to immigrants in S&E occupations

Figure 3-15.
Place of birth for foreign-born S&E degree holders: 1997



See appendix table 3-23. *Science & Engineering Indicators – 2000*

[28]Since NSF's demographic data collection system is unable to refresh its sample of those with S&E degrees from foreign institutions (as opposed to foreign born individuals with a new U.S. degree, who are sampled) more than once a decade, counts of foreign born scientists and engineers are likely to be underestimates. Foreign degreed scientist and engineers are included in the 1997 estimate only to the extent they were in the United States in April 1990. In 1993, 34.1 percent of foreign-born doctorates in S&E and 49.1 percent foreign-born bachelor's in S&E had their degrees from foreign schools.

are shown in figure 3-16. The most recent data for 1998 show a continuing decrease in permanent visas for each S&E occupation from their peaks in 1992 and 1993, after a statutory increase in the number of work-related permanent visas. The total number of immigrants with S&E occupations is now less than in 1991 before the law took effect. (See the sidebar, "Foreign Scientists and Engineers on Temporary Work Visas.")

Permanent visa numbers in recent years have been greatly affected by both immigration legislation and administrative changes at the INS. The 1990 Immigration Act led to increases in the number of employment-based visas available, starting in 1992. The 1992 Chinese Student Protection Act made it possible for Chinese nationals in the United States on student or other temporary visas to acquire permanent resident visas.

Foreign Scientists and Engineers on Temporary Work Visas

One area of policy discussion in recent years has been the use of various forms of temporary work visas by foreign-born scientists. Many newspaper and magazine stories centered on legislation which temporarily increased the 65,000 annual quota for the H-1b visa program through which individuals can get a visa to work in an occupation requiring at least a bachelor's degree for up to six years. Although this is often thought of as a visa for information technology workers, it is used to hire a wide range of skilled workers. Even when a company does not at all consider a worker to be a temporary hire, an H-1b visa can be the only way to put a worker on the job while waiting for a permanent visa. Occupational information on H-1b admissions has not been released, but data are available on the occupations for which companies have been given permission to hire H-1b visa holders (text table 3-23).* Because applications are filed by companies for positions, rather than for a particular individual, many times more applications are filed than either visas issued or applied for. Almost half (47.5 percent) of H-1b certifications were for computer-related or electrical engineering positions. Another 29.2 percent were in medical occupations, primarily as various types of therapists and technicians, but also some medical researchers. Other S&E fields were 9.0 percent, education (including professors) was 3.6 percent, and all other occupations only 10.6 percent of total 1996 H-1b certifications.

Scientists and engineers may also receive temporary work visas through intracompany transfer visas (L-1 visas), high-skill worker visas under the North American Free Trade Agreement (TN-1 visas—currently a program primarily for Canadians, but with full access for Mexican professionals coming into place in 2004), and work visas for individuals with an outstanding ability (O-1 visas), as well as several smaller programs.In addition, there is little doubt that much research is done by students (F-1 and J-1 visas); and by postdocs and visiting scientists (J-1 visas, but often H-1b or other categories). Counts of visas issued for each of these categories are shown in text table 3-24.

*The annual quota on the number of H-1b visas is controlled through the issuance of visas to workers, rather than the applications from companies. Anecdotally, some firms that expect to hire multiple workers on H-1b visas seek permission for many positions, which will also affect the distribution of occupations in text table 3-23.

Text table 3-23.
FY 1997 certifications to hire workers with H-1b temporary visas

Occupation	Certifications	Percent
Computer-related and electrical engineering	189,400	47.5
Medical	116,502	29.2
Other sciences	13,959	3.5
Other engineering and architecture	22,077	5.5
Education	14,249	3.6
Other	42,137	10.6
Total	398,324	100.0

NOTE: The actual occupational distribution of H-1b visa holders might be quite different. Certification is a permission given to a firm to try to recruit a worker who then can apply for an H-1b visa. In FY 1997, only 65,000 H-1b visas could legally be issues.

SOURCE: NSF/SRS Tabulation of Department of Labor administrative data summaries.

Science & Engineering Indicators – 2000

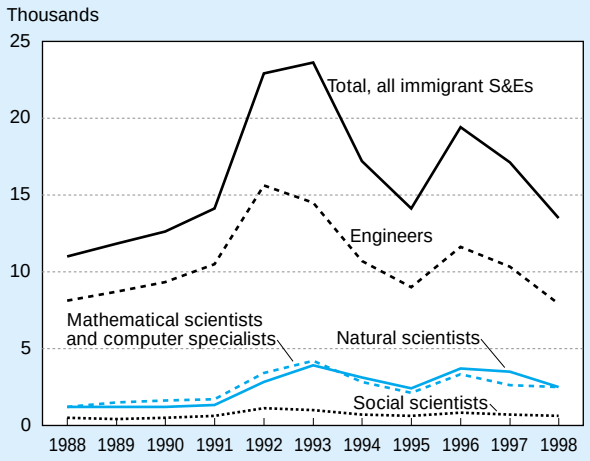
Text table 3-24.
FY 1996 temporary visas issued in major categories likely to include some scientists and engineers

Temporary work visa categories	Issued
H-1b (specialty occupations requiring the equivalent of a bachelor's degree)	58,327
L-1 (intracompany transfers)	32,098
TN (NAFTA visa for professionals)	29,252
O-1 (persons of extraordinary ability)	2,765
O-2 (workers assisting O-1)	1,594
Temporary student/exchange visa categories	**Issued**
F-1 (students)	241,003
J-1 (exchange visitors)	171,164

SOURCE: Immigration and Naturalization Service administrative records.

Science & Engineering Indicators – 2000

Figure 3-16.
Immigration and Naturalization Service counts of permanent visas with S&E occupations



See appendix table 3-24. *Science & Engineering Indicators – 2000*

These changes resulted in at least a temporary increase in the number of scientists able to obtain permanent visas.[29]

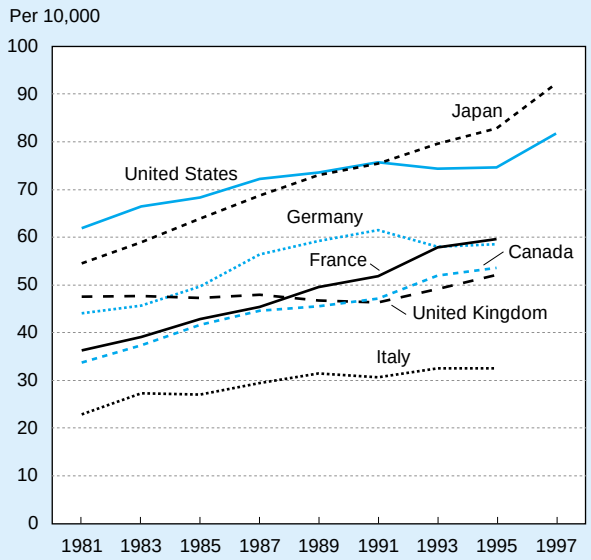
Stay Rates of Temporary Visa Ph.D. Recipients from U.S. Schools

How many of the foreign students who receive S&E Ph.D. holders from U.S. graduate schools stay in the United States? According to a report by Finn (1999), 48 percent of 1992–93 U.S. S&E doctorate recipients with temporary visas were still in the United States in 1994. By field, this percentage ranged from 29 percent in the social sciences to 55 percent in physical sciences and mathematics. (See text table 3-25.) Within each discipline, the percentage of the Ph.D. graduation cohort found in the United States increases with years since degree, reaching 53 percent in 1997. The increase in the stay rate occurs despite considerable evidence from other sources that large numbers of foreign Ph.D. recipients with U.S. degrees leave the United States after completing a postdoc, or at later points in their careers. This suggests a very dynamic picture of the international migration of Ph.D. scientists—with some graduates of U.S. schools returning to the United States even as others leave.

International R&D Employment

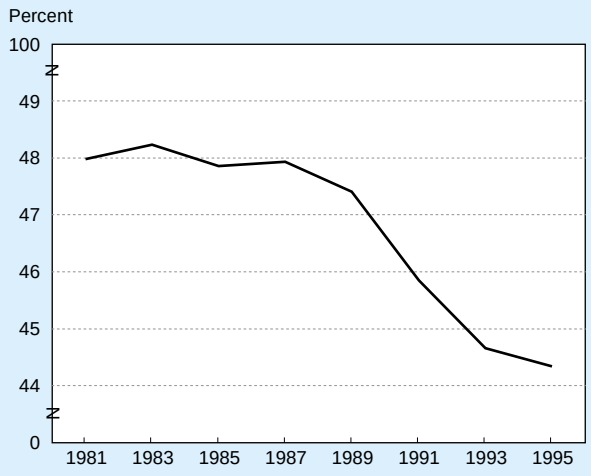
Information on the numbers of scientists and engineers engaged in R&D are contained in figure 3-17, figure 3-18, and appendix table 3-25 for the G-7 nations: the United States, Canada, France, Germany, Italy, Japan, and the United Kingdom. Since 1991, Japan has surpassed the United States in scientists and engineers engaged in R&D as a percentage of their labor force, but the United States continues to have a greater proportion of R&D workers than the other included industrial countries. In terms of total numbers of R&D scientists and engineers, the U.S. share of the G-7 total of scientists and engineers engaged in R&D, as reflected in figure 3-18, has fallen slightly from 48.0 percent in 1981 to 44.3 percent in 1995.

Figure 3-17.
S&E labor force engaged in R&D per 10,000 labor force



See appendix table 3-25. *Science & Engineering Indicators – 2000*

Figure 3-18.
U.S. scientists and engineers engaged in R&D as a percentage of the G-7 total



See appendix table 3-25. *Science & Engineering Indicators – 2000*

[29]In addition, the easier availability of occupation-based permanent visas affect the measurements—many scientists enter on family-based visas, where reporting of occupation is optional. If more of these individuals were using occupational visas, we would identify more immigrants in S&E occupations for that reason.